

DOCUMENTED RELEASE SAMPLING REPORT

FOR

SANDSTONE URANIUM MINE
GRANTS LEGACY URANIUM SITES
GRANTS, MCKINLEY COUNTY, NEW MEXICO

Prepared for

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1. INTRODUCTION

Weston Solutions, Inc. (WESTON®), the Superfund Technical Assessment and Response Team (START-3) Contractor, was tasked by the U.S. Environmental Protection Agency (EPA) Region 6 under Contract Number EP-W-06-042, Technical Direction Document (TDD) No. TO-0035-11-06-02 (Appendix G) to conduct Documented Release Sampling (DRS) at the Sandstone Uranium Mine located in McKinley County, New Mexico. Site coordinates are Latitude 35.396746° North and Longitude -107.768987° West. A Site Location Map is provided as Figure 1-1. All figures and tables are provided as separate portable document format (PDF) files. START-3 has prepared this DRS Report to provide the EPA with the field radiation scanning results and present the analytical data obtained during the field investigation performed at the Sandstone Uranium Mine.

1.1 SITE BACKGROUND

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), WESTON, was tasked to perform DRS at the Sandstone Uranium Mine located near Ambrosia Lake, McKinley County, New Mexico.

The Sandstone Uranium Mine was identified as a potential hazardous waste site and entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) under CERCLIS No. NMN000607166. According to the New Mexico Environment Department (NMED) Ground Water Quality Bureau Pre-CERCLIS Screening Assessment of Sandstone Mine, 31 March 2011, the last documented site reconnaissance occurred in 1998 by the New Mexico Energy, Minerals and Natural Resources Department (NMEMNRD). The NMEMNRD released the site in 1999 from further requirements of the New Mexico Mining Act (Reference 1). On 23 August 2011, the EPA conducted an Airborne Spectral Photometric Environmental Collection Technology (ASPECT) overflight of the Ambrosia Lake area and collected gamma radiological measurements for total uranium, exposure rate, and total count rate. The results from the ASPECT overflight indicated that elemental uranium was detected at concentrations that ranged between 20 to 30 picocuries per gram (pCi/g) or up to four times the

background concentration of 2.7 pCi/g. Figure 1-2 presents the ASPECT overflight total uranium concentration results.

START-3 has prepared this report to provide available background information collected for the Sandstone Uranium Mine, discuss the DRS activities, and present the analytical data obtained as part of the investigation.

1.2 OBJECTIVES OF THE INVESTIGATION

After reviewing the NMED memorandum and reviewing the results obtained from the ASPECT overflight, the EPA concluded that an investigation was needed to determine if hazardous substances have been released to the environment from past historical mining activities and despite reclamation histories. This investigation is designed to provide a high-confidence determination by direct observation, field measurement, and laboratory analysis that a hazardous substance has been released at the mine site, termed a “documented release.” The definition of a release under CERCLA (Section 101(22)) is *“[A]ny spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles containing any hazardous substance or pollutant or contaminant)...”* For the purpose of this investigation, a documented release can be established by chemical analysis which requires attributing the hazardous substance to the site, determining background, demonstrating that the concentration of the hazardous substance in a release sample is significantly increased above background, and attributing some portion of the significant increase to the site. EPA will use this information obtained during the DRS to determine if additional investigation and/or reclamation is warranted and to prioritize those actions for all uranium mines in the Grants Mining District.

1.3 SCOPE OF WORK

The DRS Scope of Work is intended to describe the tasks requiring completion in order to evaluate the Sandstone Uranium Mine. As part of this DRS, START-3 performed the following major tasks:

- Prepared a site-specific Quality Assurance Sampling Plan (QASP), approved by the EPA, and Health and Safety Plan (HASP) prior to sampling activities.
- Evaluated the available information from the on-site observations, historical aerial photographs, area environmental information, and historical documents provided by the EPA.
- Conducted DRS field sampling/scanning activities on 27 September 2011. Samples were collected at various locations with the highest 1-minute stationary gamma measurements. The samples were collected in general accordance with the site-specific QASP and HASP to document the presence and migration of hazardous substances attributable to the Sandstone Uranium Mine.
- Submitted the DRS samples to National Environmental Laboratory Accreditation Program (NELAP) certified laboratories for analysis and reviewed and tabulated the resulting data.
- Compared the laboratory results to three times the background concentrations to establish a documented release.
- Prepared this report to present the findings of the DRS.

1.4 REPORT FORMAT

The DRS report contains the following sections:

- Section 1 – Introduction
- Section 2 – Site Characteristics
- Section 3 – Documented Release Sampling
- Section 4 – Summary
- Section 5 – References

Additional information is provided in the following appendices:

- Appendix A Digital Photographs
- Appendix B START-3 Site Logbook
- Appendix C START-3 Quality Assurance Sampling Plan
- Appendix D Laboratory Data Packages
- Appendix E Laboratory Data Validation Packages
- Appendix F Reference Documentation
- Appendix G TDD No. 0035-11-06-02 and Amendments A-B

Tables and figures cited in this report are provided as PDF files. Photographs taken during the DRS activities are provided as Appendix A. The START-3 field logbook notes are provided as Appendix B. The site-specific QASP is provided as Appendix C.

2. SITE CHARACTERISTICS

Information regarding the site location, description, and site history is included in the following subsections.

2.1 SITE LOCATION AND DESCRIPTION

The Sandstone Uranium Mine is within the Ambrosia Lake Mining District, located 19 miles north-northwest of Grants in McKinley County, New Mexico. The reclaimed area of the Sandstone Mine Site is approximately 4 acres in size. The Sandstone Uranium Mine can be reached from Grants, New Mexico via Highway 605 north for 13 miles, then turning west on Highway 509 for approximately 4.5 miles until a gated gravel road leads east toward the Sandstone Uranium Mine.

2.2 SITE HISTORY

The Grants Mining District provided significant uranium extraction and production in New Mexico from the 1950s until late in the 20th century. Ninety-seven former legacy uranium mines and five mill sites have been identified in the Ambrosia Lake, Laguna, and Marquez subdistricts.

The Sandstone Mine was operated as a wet mine, with the ore body being below the water table. A vertical shaft was sunk to a depth of 940 feet in order to access the ore body below the water table and groundwater was discharged at a rate of 0.51 million gallons per day. The mine was operated from the 1950s until 1980. The mine prior to 1971 produced 1 million tons of uranium ore. The New Mexico Energy, Minerals and Natural Resources Department released the Sandstone Uranium Mine in 1999. Surface water flow drainage appears to be across the mine area toward the southwest and into the Voght Tank and an associated arroyo. The arroyo trends northeast-southwest and drains into an area approximately 1.5 miles southwest of the mine, near the Rio Algom Mill settling ponds. The Voght Tank is unlined surface impoundment which appears to be approximately 10 acres in size when full, judging by historical aerial imagery and observations during the site reconnaissance performed by START-3 on 27 September 2011 and are thought to have received effluent from several wet mines in the area during mining operations (Reference 1).

3. DOCUMENTED RELEASE SAMPLING

The specific information regarding field observations, sampling activities, background determination, gamma scanning and measurements, soil sampling and deviations from the QASP are included in the following subsections (Reference 2).

3.1 OVERVIEW

START-3 was tasked to conduct DRS of the Sandstone Uranium Mine, including collecting environmental samples, gamma scanning approximately 10% of the mine area, and collecting 70 stationary 1-minute gamma measurements. The specific sampling objectives were to collect data that could be used to document a release of hazardous substances to the environment as a result of historical mining operations. The constituents of concern (CoCs) include all identifiable gamma emitting radioisotopes, specifically the daughters of uranium-238 (U-238), and radium-226 (Ra-226). Additional CoCs include arsenic, molybdenum, selenium, and total uranium.

START-3 implemented the QASP at the Sandstone Uranium Mine Site on 27 September 2011. START-3 collected gamma measurements sufficient to provide approximately 10% coverage of the surface area of the mine. Figure 3-1 illustrates the assessment area. Mine area gamma radiation distribution results are presented in Table 3-1. In addition, 1-minute stationary gamma measurements were collected at 70 evenly spaced grid locations throughout the mine area. The stationary gamma measurements are listed in Table 3-2 and the locations are presented on Figure 3-2. In addition, 10 soil samples and 1 duplicate soil sample were collected at the 1-minute stationary locations which had elevated gamma activity. Three background soil samples, shown on Figure 3-1, were collected to the east, south, and west near the perimeter of the mine area, and 1-minute stationary readings were collected at each location. The locations of the background samples are presented on Figure 3-1 and the 1-minute gamma measurements are listed in Table 3-2.

Surface soil samples were collected and submitted to a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory for the following analyses: total metals including arsenic, molybdenum, selenium and total uranium by Methods SW846 6010/6020 and 7470/7471, and all identifiable gamma emitting radioisotopes by Method LANL ER-0130 gamma

spectrometry. One sample was also analyzed for isotopic uranium and thorium by ASTM 3972-90M alpha spectrometry, after the sample was suspected to be in disequilibrium upon reviewing the gamma spectrometry results. The analytical data were validated by START-3. Laboratory analytical results for radioisotopes and metals are presented in Tables 3-3 and 3-4, respectively. The laboratory data packages are included in Appendix D. The validated laboratory data packages are included in Appendix E.

3.2 FIELD OBSERVATIONS

The site reconnaissance took place on 27 September 2011. The weather was sunny, with a high temperature of 79 degrees Fahrenheit and light winds. The mine area was generally flat, and was fairly uniformly covered in desert grass vegetation, although grass density varied depending on location. During the site reconnaissance, it was noted that the mine area appeared to be capped with an orange colored sandy soil. Gamma readings on top of this soil layer, for the most part, were significantly lower than the rest of the mine site. This layer of soil appeared to vary from 6 inches to 2 feet thick. Underneath the orange colored soil was a light gray layer of soil. Each time this layer was encountered, gamma radiation measurements spiked. To confirm this observation, it was noted that several fire ant mounds on the mine site had some of the grayish soil within the mound, which apparently the ants had dug up through the orange soil layer. Gamma readings were higher at each ant mound which contained the grey colored soil.

3.3 BACKGROUND DETERMINATION

The START-3 QASP (Reference 2) protocol determines the background for the each individual legacy mine as the mean of the field measurements and laboratory results of samples collected from four locations at the perimeter of the property. These four sample locations correspond to the four cardinal directions of the compass (north, east, south, and west). The protocol indicates that a site background location should have similar physical, chemical, geological, radiological, and biological characteristics of the legacy mine site if there were are no impacts from uranium mining and milling at the site. START-3 collected three background soil samples to the east, south and west of the mine site, where 1-minute stationary gamma measurements were also collected. It was determined that a representative background sample could not be collected on

or near the northern perimeter of the Sandstone Uranium Mine, as gamma radiation measurements were significantly higher than those collected on the remainder of the mine area. During the Sandstone Uranium Mine investigation, it was noted that whenever a grayish colored soil was encountered, gamma activity was significantly elevated. The northern area of the Sandstone Uranium Mine and beyond appeared to be comprised of mostly the grayish colored soil, where gamma scanning measurements were frequently reading in excess of 100,000 counts per minute (cpm). In addition, the background sample on the east side of the Sandstone Uranium Mine appeared to be in disequilibrium after START-3 reviewed the alpha spectrometry results for U-238 and Th-230. The data, shown in Table 3-3, demonstrates that the Ra-226 and Th-230 results are not in equilibrium with the uranium isotopes, and may be indicative that the soil contains uranium tailings and not uranium ore. Due to these results, the eastern background sample will not be used in calculating the background average for comparison to the Sandstone Uranium Mine soil sample results.

3.4 GAMMA SCANNING

Due to the size of the Sandstone Uranium Mine, it was determined that approximately 10% of the surface area would be scanned using a 2X2 NaI detector held approximately 1 meter above the ground surface in conjunction with a Global Positioning System (GPS) unit. Evenly placed transects were walked across the mine site from one end of the disturbed claim boundary to another. Each transect was spaced approximately 100 feet apart. One-second measurements of gamma activity were recorded and electronically attached to the appropriate GPS designation for the subsequent plotting and depiction of the ambient gamma activity. A total of 4,453 gamma radiation measurements were collected from the mine area, ranging from 15,663 cpm to 708,230 cpm. Sandstone Uranium Mine gamma radiation results and statistics can be observed in Table 3-1 and on Figure 3-1.

3.5 STATIONARY GAMMA MEASUREMENTS

Stationary 1-minute gamma measurements were collected at 70 to 100 foot evenly spaced grid locations across the Sandstone Uranium Mine, using the same type of instrumentation and at the

same height above the ground surface as the gamma scanning measurements. Because the stationary measurements are integrated over 1-minute intervals versus 1-second intervals, the measurements provide a more accurate measurement of the ambient gamma activity at that point. The QASP protocol states that a single-point measurement greater than two times the background average concentration indicates a documented release at the mine (Reference 2). At the 70 total stationary locations, gamma measurements ranged from 24,546 cpm to 284,992 cpm, with 25 measurements exceeding two times the background average measurement of 18,143 cpm. The stationary measurement locations and measurements are illustrated in Figure 3-2 and presented in Table 3-2.

3.6 SOIL SAMPLING

START-3 collected 10 soil samples (including 3 background and 1 duplicate sample) at 0 to 6-inch depth at locations identified by the stationary measurements as being suspect. Figure 3-2 depicts the sampling locations, and Table 3-2 presents the 1-minute stationary gamma measurements at each sample location. Surface soil samples were collected and submitted for total metals including arsenic, molybdenum, selenium and total uranium by Methods SW846 6010/6020 and 7470/7471, and all identifiable gamma emitting radioisotopes by Method LANL ER-0130 Gamma Spectrometry. Sample SSBKGD-E was also analyzed for isotopic uranium and thorium by ASTM 3972-90M alpha spectrometry, after the sample was suspected to be in disequilibrium upon reviewing the Gamma Spectrometry results. The QASP states that if any sample contains U-238 as determined by alpha spectrometry or Ra-226 as determined by gamma spectrometry at a concentration equal to or greater than three times the mean background average concentration, the mine will be identified as having a documented release (Reference 2). Seven samples from the Sandstone Uranium Mine exceeded three times the background average concentration for Ra-226. The analytical data were validated by START-3. The metals and radioisotopes laboratory results are included in Tables 3-3 and 3-4. Data are presented in Tables 3-2 and 3-3. The validated laboratory data packages are included in Appendix E.

3.7 DEVIATIONS FROM THE QASP

The following deviations from the QASP occurred during the field work:

- A suitable background sampling location on the northern side of the Sandstone Uranium Mine could not be located due to significantly elevated gamma scan readings and a noticeable difference in the physical landscape. Background locations should have similar physical, chemical, geological, radiological, and biological characteristics as the legacy mine site.
- The background sample on the east side of the Sandstone Uranium Mine appeared to be in disequilibrium after START-3 reviewed the alpha spectrometry results for U-238 and Th-230. The data demonstrates that the Ra-226 and Th-230 results are not in equilibrium with the uranium isotopes, and may be indicative that the soil contains uranium tailings and not uranium ore. Due to these results, the eastern background sample will not be used in calculating the background average.
- Gamma scanning for the Sandstone Uranium Mine did not fully cover 10% of the mine area as described in the QASP. The larger size of the Sandstone Uranium Mine and time restrictions were limiting factors. It is estimated that approximately 8% of the site was covered during the gamma scan. The gamma scan took approximately 3 hours to complete. This is not expected to have an impact on the conclusion of the assessment at the Sandstone Uranium Mine.

4. SUMMARY

START-3 conducted DRS at the Sandstone Uranium Mine on 27 September 2011 that included collecting surface gamma radiation measurements, in addition to conducting sampling and performing chemical/radiological analyses of surface soil. The specific sampling objectives for the DRS were to collect data that could be used to document a potential release of hazardous substances to the environment and to potentially warrant further site investigation and/or reclamation. Based on the results of the DRS sampling event, soil contamination attributable to the Sandstone Uranium Mine was documented via these contributing factors:

- Twenty-five out of the 70 stationary 1-minute gamma measurement locations had readings higher than two times the mean background average reading of 18,144 cpm, indicating a documented release.
- Ra-226 soil sampling results from the Sandstone Uranium Mine ranged from 4 to 184 pCi/g. Seven sample results significantly exceeded three times the background Ra-226 result average of 2.70 pCi/g for the mine. This indicates a documented release at the Sandstone Uranium Mine.
- Arsenic, molybdenum and selenium were detected in soil samples that exceeded three times background concentrations, indicating a documented release at the Sandstone Uranium Mine.

5. REFERENCES

1. NMED (New Mexico Environment Department). Pre-CERCLIS Screening Assessment of the Sandstone Mine. 31 March 2011.
2. Weston Solutions, Inc. Quality Assurance Sampling Plan for the Sandstone Uranium Mine, Grants, McKinley County, New Mexico. September 2011.